

(Diesel)

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UNITED STATES DEPARTMENT OF LABOR  
MINE SAFETY AND HEALTH TECHNOLOGY CENTER

Underground LHD &  
Fluffly

NOISE CONTROL  
TECHNICAL ASSISTANCE

Beaverhead Mine  
Cyprus Industrial Minerals Company  
Alder, Madison County, Montana

April 25, 1989

by

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## INTRODUCTION

On April 25, 1989, technical assistance was provided to Cyprus Industrial Mineral's Beaverhead Mine near Alder, Montana. A request was received from Chris Brown, Director of Safety and Loss Control, for the Company to (1) quiet a Jarvis Clark <sup>1/</sup> 250M LHD unit (figure 1) and (2) to survey a Hanna-Beric cement backfill machine. The assistance of Chris Brown and Michael Toelle of Cyprus was much appreciated.

## BACKGROUND

The Company had installed an engine exhaust muffler on the LHD as shown in figure 2.

Figure 3 is a mine map showing the route traveled by the LHD on the day of the visit. The prime stationary source along the route was an 18-inch Joy secondary fan, indicated by the arrow in figure 3. The two 18-inch fans near the shaft station also contributed to the background noise level but to a lesser extent.

## TESTING AND RESULTS

### LHD

The LHD was tested during actual production runs, following the course depicted in figure 3. A Nagra SNN tape recorder was used to record sound levels as the LHD traveled the test route. The resulting tapes were analyzed for overall level and frequency content.

Figure 4A shows the variation in noise level during one production cycle. The confining nature of the mine environment is shown as the LHD exits the mine (right side of graph) with a resulting drop in noise level of about 5 dBA.

The graph in figure 4B shows the noise level of the fan near the powder magazine, and the two fans near the shaft station, without the LHD present. The overall level for the prime source fan was approximately 105 dBA.

The total test-cycle time in the mine was 9.4 minutes, of which approximately 1 minute was spent near the prime source fan.

The muffler on the LHD unit reduced the low frequency exhaust noise, as the usual frequency bands involved (80Hz-250Hz) were not adding to the overall level. Figures 5 through 10 show the frequency spectra of the LHD during different test conditions.

A statistical sampling of the noise levels encountered during the test run (underground) showed an average level of 96.8 dBA (figure 4A), and a corresponding dose of 5 percent for this 9.4 minute test run. Time spent on the surface tramping and dumping was at or below 90 dBA, and should not contribute significantly to the overall exposure.

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<sup>1/</sup> References to specific brand names is made only for purpose of identification and does not imply endorsement by MSHA.

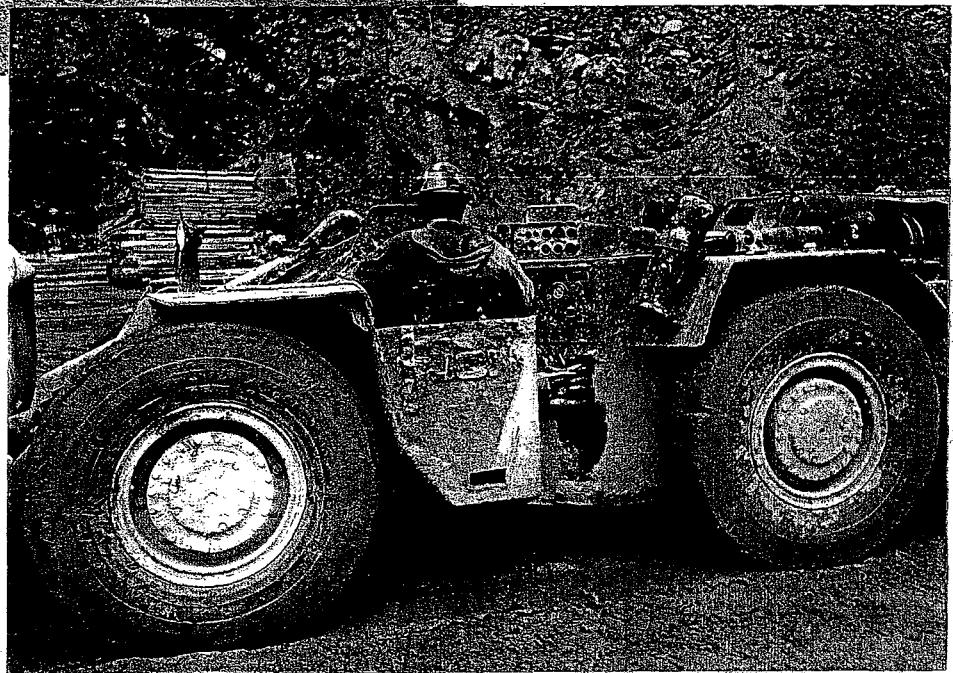
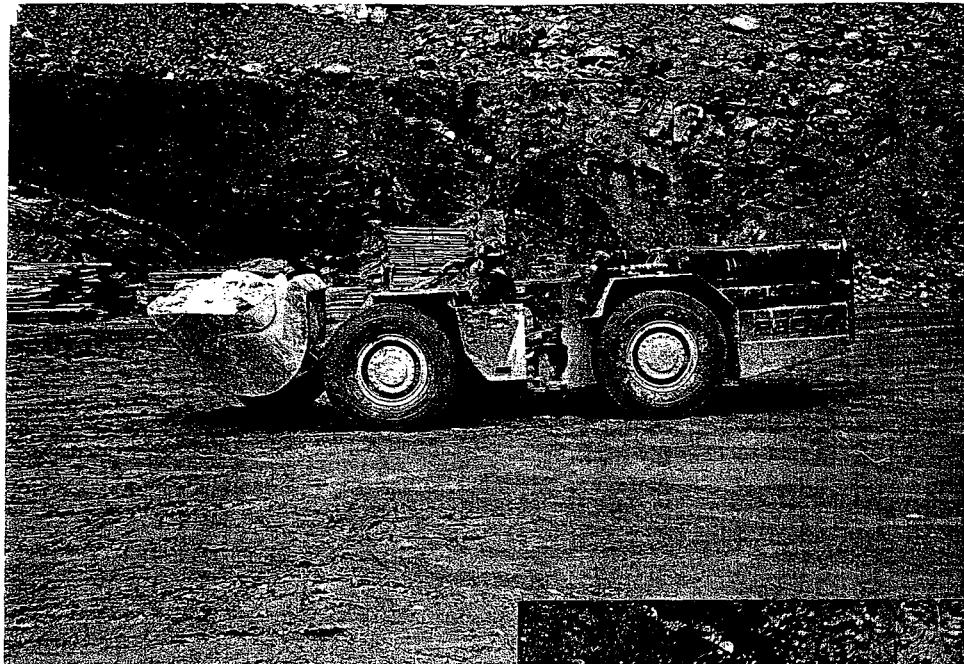


FIGURE 1.—Jarvis Clark  
250M load-haul-dump  
unit.



FIGURE 2.—Exhaust system on  
the J-C 250 LHD.

Hanna-Beric Backfill

Figures 11 and 12 show the Hanna-Beric compressor at start-up and normal operation respectively. The high level start-up is of short duration (5 sec.) and should not contribute significantly to the overall dose. The overall level for normal operation is fairly constant at 90 dBA.

## RECOMMENDATIONS

LHD

Present MSHA policy requires that where feasible, engine exhaust mufflers, barriers and absorbing materials, or enclosed cabs be used to reduce the noise exposure. The following comments are relevant to the policy and conditions as observed:

1. The Company's installation of an exhaust muffler was adequate in reducing low frequency noise.
2. This LHD unit is divided at its articulation point; with the operator and bucket on one half, and the engine and transmission on the other (figure 1). The operator's distance from the main sources, e.g., engine fan, exhaust, and transmission make the use of barrier panels and absorbers/covers inefficient. Barriers placed near noise sources would have to be extremely large in order to create an acoustical shadow zone for the operator. Large areas of the engine compartment would have to be covered to achieve any significant reduction, especially in the highly reverberant environment of the mine (figure 4A).

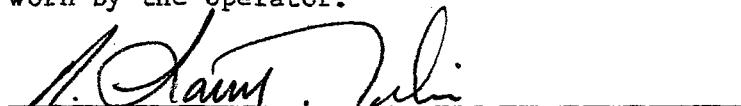
The engine exhaust muffler is the only efficient control for this LHD unit under the conditions tested. A different model LHD used in the same mining environment and equipped with a muffler, may gain additional attenuation by the use of barriers and absorbing materials.

3. The narrow dimensions of the haulage drift, along with ventilation tubing hung from it's roof, make the installation of an operator cab infeasible.
4. Although exposure from the prime source fan is of the pass-by type, one quieting technique may be considered. This control consists of adding hard extension tubing to the fan intake and exhaust, and applying fiberglass insulating material to the tubes and fan housing. The enclosed T-Gram entitled, Development of Innovative Low Cost Fan Silencer, will give details.
5. Hearing protection must be worn by the LHD operator.

Hanna-Beric Backfill

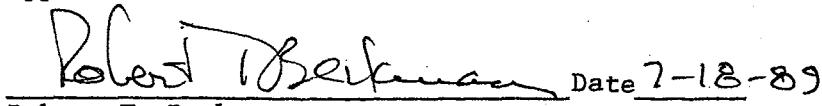
The backfill machine is usually operated less than 8 hours per shift. The levels measured during the survey show that the operator should be in

compliance during normal operation. Hearing protection should continue to be worn by the operator.



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Physical Agents Division

Approved:

 Date 7-18-89

Robert T. Beckman  
Chief, Physical Agents Division  
Safety and Health Technology Center

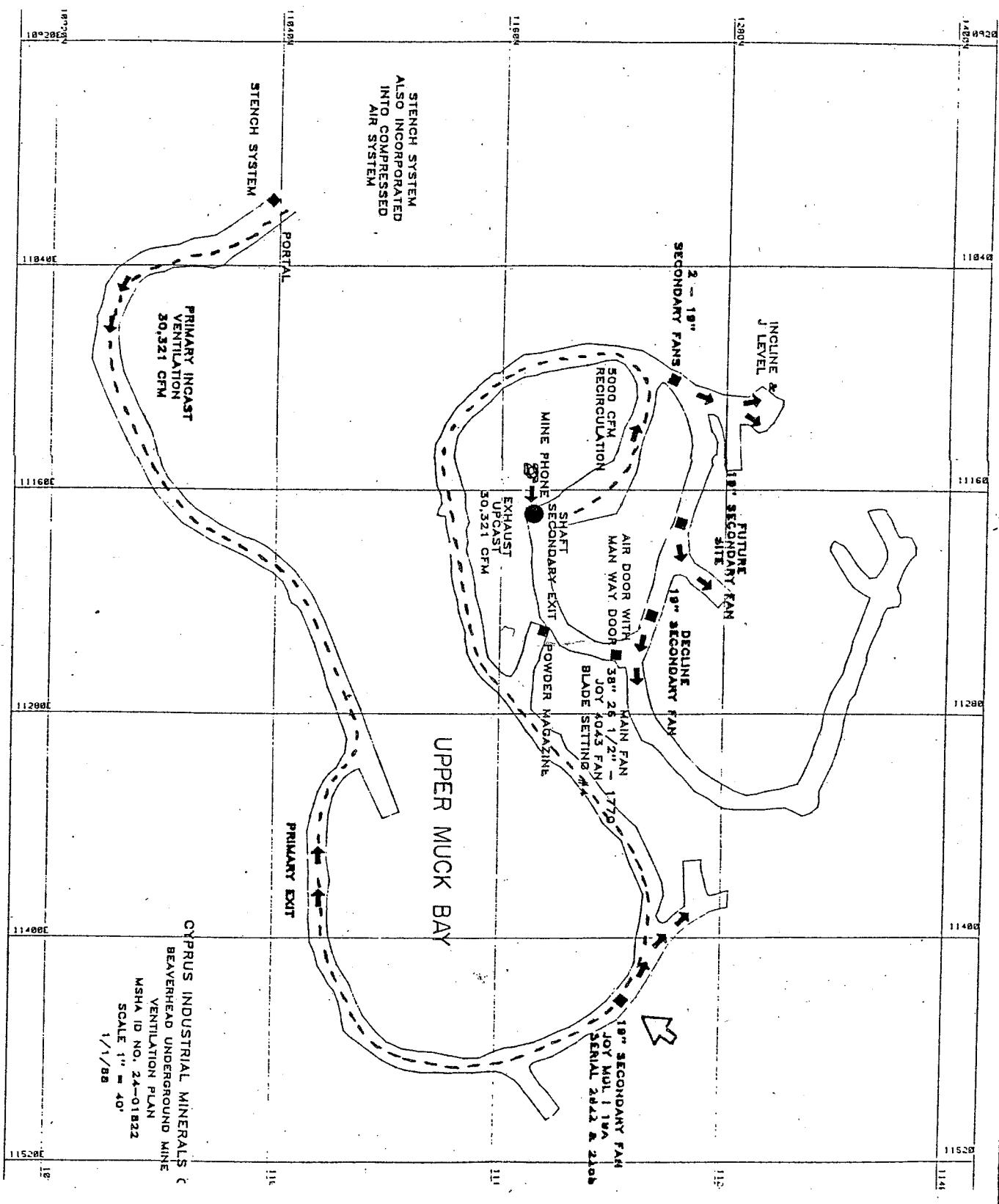


FIGURE 3.- Route of Jarvis Clark 250M LHD during tests.

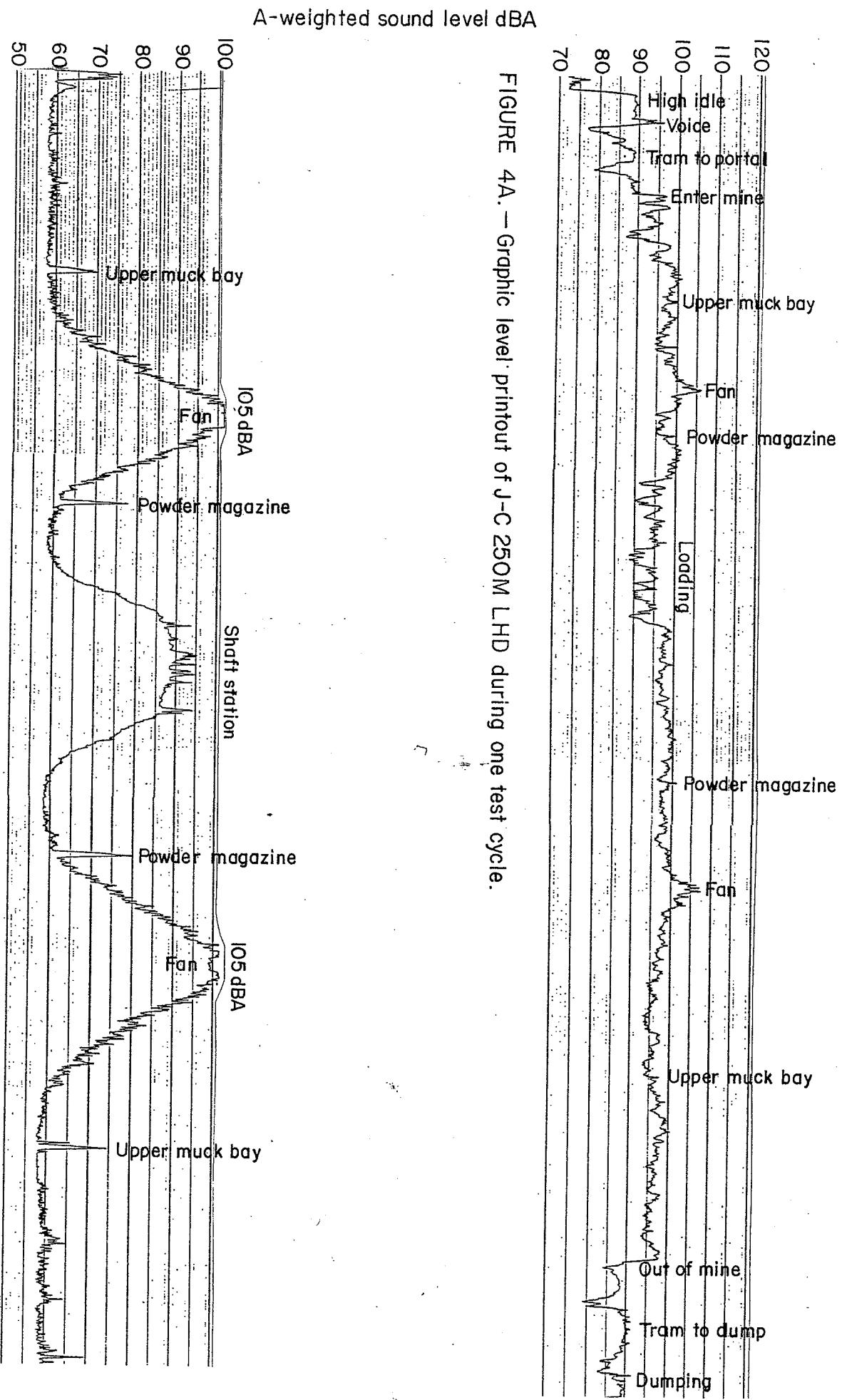


FIGURE 4A.—Graphic level printout of J-C 250M LHD during one test cycle.

FIGURE 4B.—Graphic level printout of background noise during walk-through along test route.

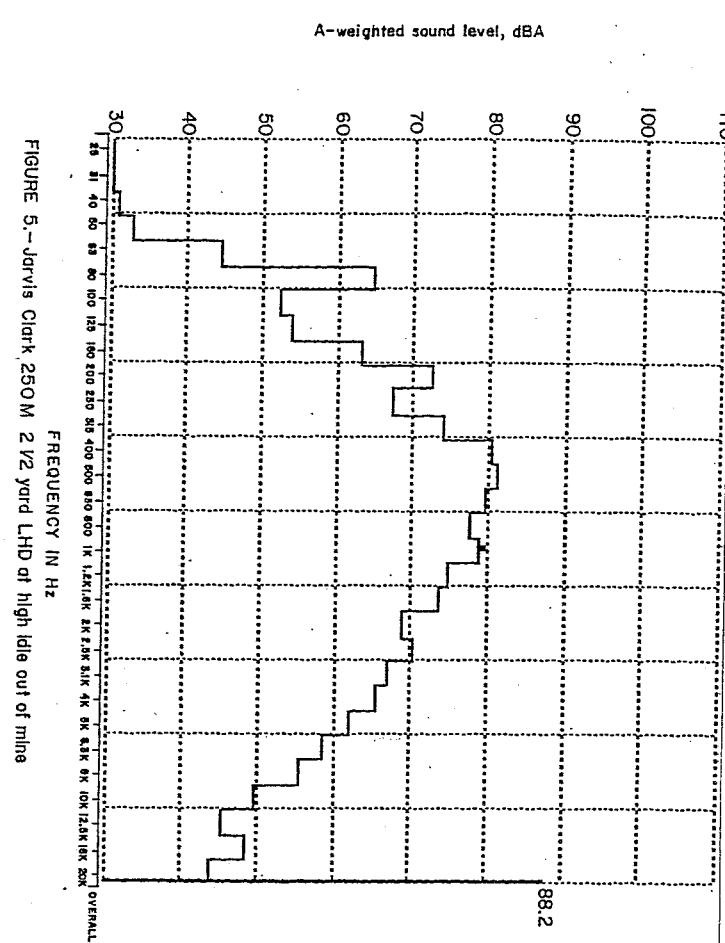
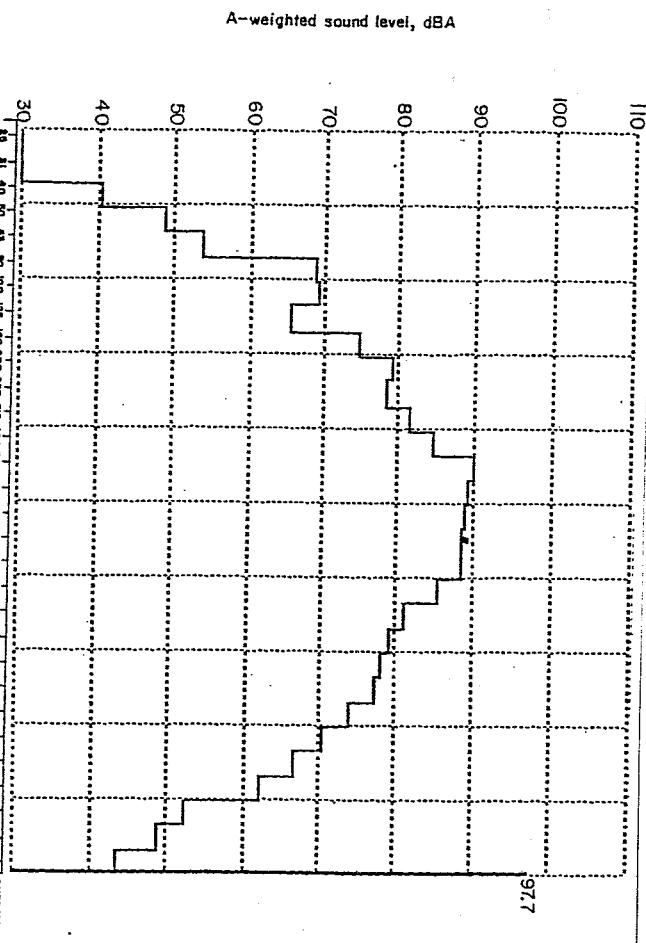


FIGURE 5.-Jervis Clark 250M 2 1/2 yard LHD at high idle out of mine

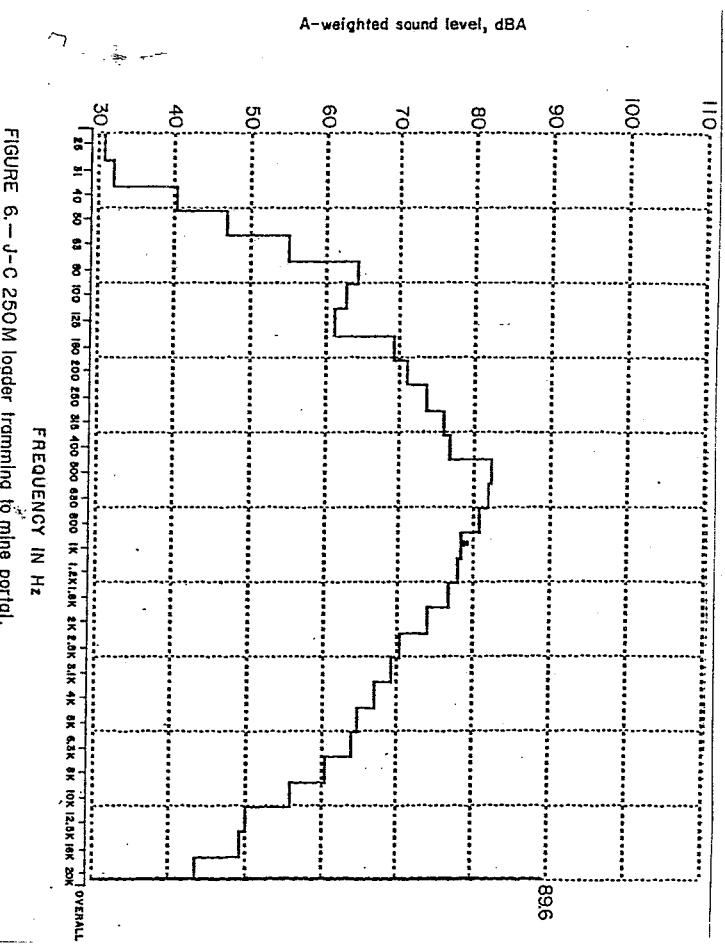
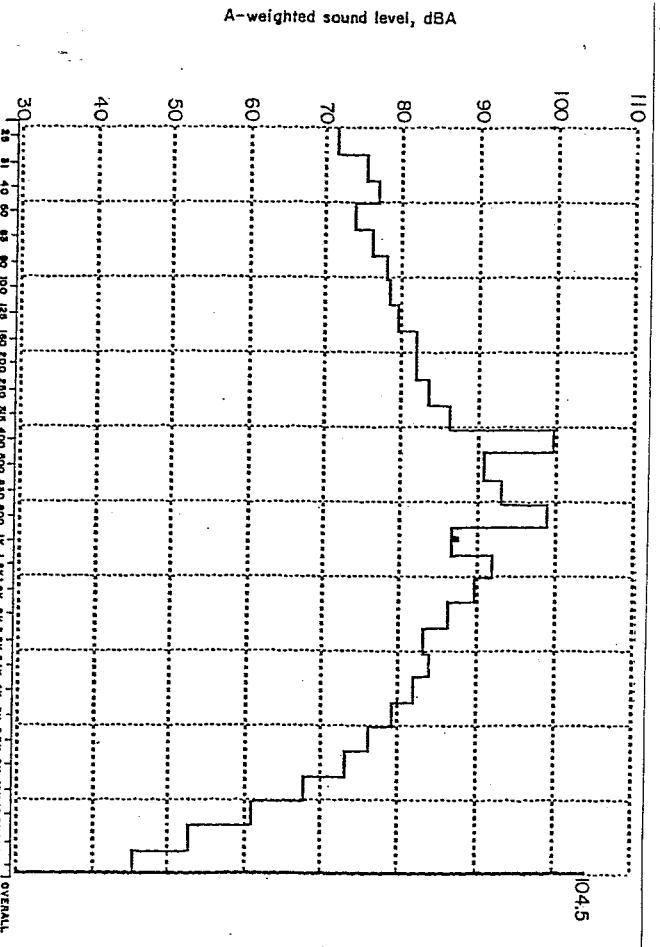


FIGURE 6.-J-C 250M loader trams to mine portal.

FIGURE 7.-J-C 250M LHD in mine at upper muck bay.

FIGURE 8.-J-C 250M LHD in mine at Joy 1B inch fan.

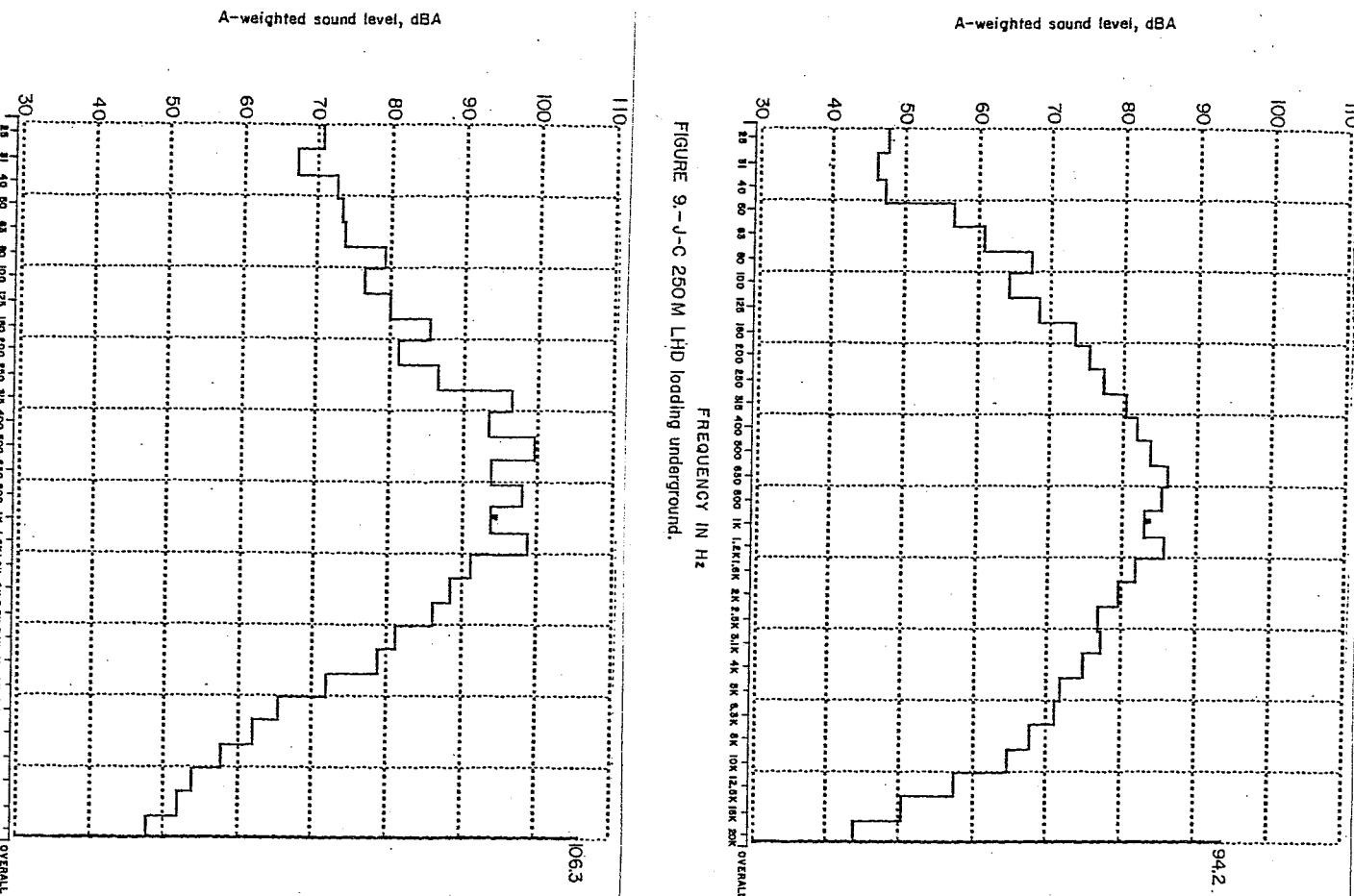


FIGURE 9.—J-C 250M LHD loading underground.

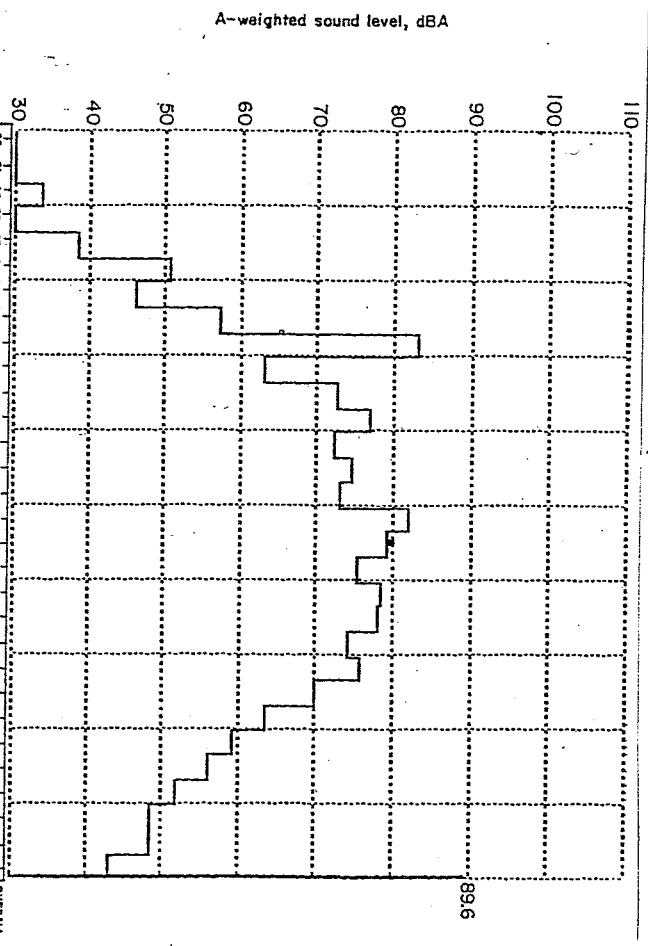


FIGURE 10.—J-C 250 M LHD trammimg, loaded out of mine.

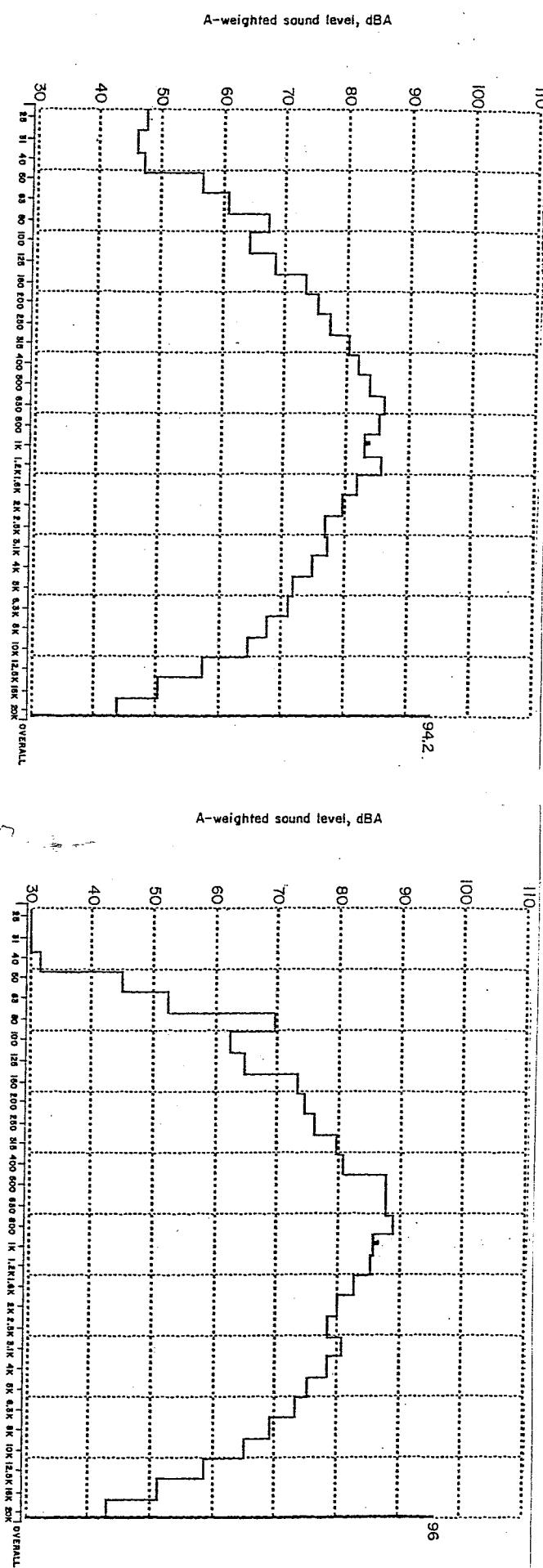


FIGURE 11.—Hanna-Beric compressor at start-up.

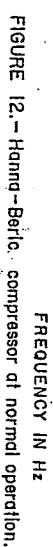


FIGURE 12.—Hanna-Beric compressor at normal operation.